

1. PUBLIC HEALTH STATEMENT

This statement was prepared to give you information about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene and to emphasize the human health effects that may result from exposure to them. The Environmental Protection Agency (EPA) has identified 1,408 hazardous waste sites as the most serious in the nation. These sites comprise the “National Priorities List” (NPL): those sites which are targeted for long-term federal cleanup activities. Naphthalene has been found in at 536 sites, 1-methylnaphthalene at 31 sites, and 2-methylnaphthalene at 328 of the sites on the NPL. However, the number of NPL sites evaluated for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene is not known. As EPA evaluates more sites, the number of sites at which naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene is found may increase. This information is important because exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene may cause harmful health effects and because these sites are potential or actual sources of human exposure to these chemicals.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You can be exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking substances containing the substance or by skin contact with it.

If you are exposed to substances such as naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene, many factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, gender, nutritional status, family traits, lifestyle, and state of health.

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1.1 WHAT ARE NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE?

Naphthalene is a white solid that evaporates easily. It is also called mothballs, moth flakes, white tar, and tar camphor. When mixed with air, naphthalene vapors easily burn. Fossil fuels, such as petroleum and coal, naturally contain naphthalene. Burning tobacco or wood produces naphthalene. The major products made from naphthalene are moth repellents, in the form of mothballs or crystals, and toilet deodorant blocks. It is also used for making dyes, resins, leather tanning agents, and the insecticide, carbaryl.

Naphthalene has a strong, but not unpleasant smell. Its taste is unknown, but must not be unpleasant since children have eaten mothballs and deodorant blocks. You can smell naphthalene in the air at a concentration of 84 parts naphthalene per one billion parts (ppb) of air. You can smell it in water when 21 ppb are present.

1-Methylnaphthalene is a naphthalene-related compound which is also called alpha methylnaphthalene. It is a clear liquid. Its taste and odor have not been described, but you can smell it in water when only 7.5 ppb are present.

Another naphthalene-related compound, 2-methylnaphthalene, is also called beta methylnaphthalene. It is a solid like naphthalene. The taste and odor of 2-methylnaphthalene have not been described. Its presence can be detected at a concentration of 10 ppb in air and 10 ppb in water.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes, resins, and, for 2-methylnaphthalene, vitamin K. Along with naphthalene, they are present in cigarette smoke, wood smoke, tar, and asphalt, and at some hazardous waste sites.

See Chapters 3, 4, and 5 for more information on the properties and uses of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

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1.2 WHAT HAPPENS TO NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE WHEN THEY ENTER THE ENVIRONMENT?

Naphthalene enters the environment from industrial uses, from its use as a moth repellent, from the burning of wood or tobacco, and from accidental spills. Naphthalene at hazardous waste sites and landfills can dissolve in water. Naphthalene can become weakly attached to soil or pass through the soil into underground water.

Most of the naphthalene entering the environment is from the burning of woods and fossil fuels in the home. The second greatest release of naphthalene is through the use of moth repellents. Only about 10% of the naphthalene is from coal production and distillation, and less than 1% is attributable to naphthalene production losses. Cigarette smoking also releases small amounts of naphthalene.

Naphthalene evaporates easily. That is why you can smell mothballs. In the air, the moisture and sunlight make it break down, often within 1 day. The naphthalene can change to 1-naphthol or 2-naphthol. These chemicals have some of the toxic properties of naphthalene. Some naphthalene will dissolve in water in rivers, lakes, or wells. Naphthalene in water is destroyed by bacteria or evaporates into the air. Most of the naphthalene will be gone from rivers or lakes within 2 weeks. Naphthalene breaks down faster in water containing other pollutants, such as petroleum products.

Naphthalene binds weakly to soils and sediments. It easily passes through sandy soils to reach underground water. In soil, some microorganisms break down naphthalene. When near the surface of the soil, it will evaporate into air. Healthy soil will allow the growth of microorganisms which break down most of the naphthalene in 1 to 3 months. If the soil has few microorganisms, it will take about twice as long.

Microorganisms may change the chemical structure of naphthalene. Some common bacteria grow on naphthalene, breaking it down to carbon dioxide.

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Naphthalene does not accumulate in the flesh of animals and fish that you might eat. If dairy cows are exposed to naphthalene, some naphthalene will be in their milk; if laying hens are exposed, some naphthalene will be in their eggs. Naphthalene and the methylnaphthalenes have been found in very small amounts in some samples of fish and shellfish from polluted waters.

Scientists know very little about what happens to 1-methylnaphthalene and 2-methylnaphthalene in the environment. These compounds are similar to naphthalene and should act like it in air, water, or soil.

See Chapters 4 and 5 for more information on what happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene in the environment.

1.3 HOW MIGHT I BE EXPOSED TO NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE?

You are most likely to be exposed to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene from the air. Outdoor air contains low amounts of these chemicals, but burning wood or fossil fuels and industrial discharges can raise levels in the air surrounding them. This is true in cities with polluted air. Typical air concentrations for naphthalene are low, 0.2 ppb or less. Studies of outdoor air reported concentrations of 0.09 ppb 1-methylnaphthalene and 0.011 ppb 2-methylnaphthalene. In homes or businesses where cigarettes are smoked, wood is burned, or moth repellents are used, the levels of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene in the air are higher. Studies of indoor air typically report that average ambient air concentrations of these contaminants are less than 1 ppb.

You are not likely to be exposed to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene by eating foods or drinking beverages from a store. These materials are unlikely to come in contact with naphthalene or methylnaphthalenes during production or

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processing Naphthalene and the methylnaphthalenes are also unlikely to be present in tap water.

If you live near a hazardous waste site and have a drinking water well, you might be exposed to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene. For this to happen, the chemicals must pass through the soil and dissolve in the underground water that supplies your well. Children might also contact these chemicals by playing in or eating the dirt near a waste site.

Work using or making moth repellents, coal tar products, dyes, or inks could expose you to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene in the air. Working in the wood preserving, leather tanning, or asphalt industries could expose you to naphthalene.

Using moth repellents containing naphthalene in your home will expose you to naphthalene vapors. Use of naphthalene-treated clothing, blankets, or coverlets will expose you to naphthalene both by contacting your skin and by breathing its vapors. Cigarette smokers are exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene in the smoke. The highest airborne naphthalene concentrations in nonoccupational settings occur in the homes of cigarette smokers.

See Chapter 5 for more information on how you might be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

1.4 HOW CAN NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE ENTER AND LEAVE MY BODY?

Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene can enter your body if you breathe air that contains these chemicals, if you smoke, if you eat mothballs, if you drink water that contains these chemicals, or if they touch your skin. These chemicals are most likely to enter your body through the air you breathe into your lungs. Naphthalene can also enter your body through your skin when you handle mothballs, particularly if you have used

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an oil-based skin lotion. You can also breathe in naphthalene vapors from clothes that have been stored in mothballs.

Once naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene enters your body, small amounts will dissolve in your blood. Your blood carries them to your liver and other organs. These organs change them so that they pass through your body, mainly into your urine. Some naphthalene, 2-methylnaphthalene, and their breakdown products can be present in your stool. Naphthalene has also been found in breast milk. Mother's milk and other secretions can also remove them from your body. It may take several weeks for all traces of naphthalene to leave your body.

Scientists do not know very much about 1-methylnaphthalene and 2-methylnaphthalene, but they think that they act somewhat like naphthalene in your body. Both of these compounds seem to be less toxic than naphthalene.

See Chapter 2 for more information on how naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene enter and leave your body.

1.5 HOW CAN NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE AFFECT MY HEALTH?

Exposure to a large amount of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This problem is called hemolytic anemia. People, particularly children, have developed this problem after eating naphthalene-containing mothballs or deodorant blocks. Anemia has also occurred in infants wearing diapers after storage in mothballs. If you are black or from a Mediterranean country, naphthalene may be more dangerous to you than to people of other races or nationalities. These populations have a higher incidence of problems with the enzyme, glucose-6-phosphate dehydrogenase (G6PD). This enzyme normally protects red blood cells from specific chemical damage created by oxygen in the air.

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Some of the symptoms that occur with hemolytic anemia are fatigue, lack of appetite, restlessness, and a pale appearance to your skin. Exposure to a lot of naphthalene may cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. If you have these symptoms, you should see a doctor quickly.

If you are a pregnant woman and anemic due to naphthalene exposure, there is a good chance that your unborn child will be anemic as well. Naphthalene can move from your blood to your baby's blood. Once your baby is born, naphthalene may also be carried from your body to your baby's body through your milk. It is not completely clear if naphthalene causes reproductive effects in animals; most evidence says it does not.

Laboratory rabbits, guinea pigs, mice, and rats sometimes develop cataracts (cloudiness) in their eyes after swallowing naphthalene. It is not clear if cataracts also develop in humans exposed to naphthalene, but the possibility exists.

When mice were repeatedly exposed to naphthalene vapors for 2 years, their noses and lungs became inflamed and irritated. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene seem to damage some cells in the lining of the lungs. When given naphthalene in their diets, mice had some effects in the spleen and thymus. Female mice that were exposed to naphthalene daily throughout their lives developed lung cancer that may have been related to their naphthalene exposure. Male rats or mice did not develop lung cancer.

The carcinogenicity (cancer causing ability) of naphthalene has not been determined. The Department of Health and Human Services (DHHS) has determined that naphthalene may cause cancer in female mice but not in male mice or rats of either sex. The International Agency for Research on Cancer (IARC) has determined that naphthalene is not classifiable as to its carcinogenicity to humans. The EPA has determined that naphthalene is not classifiable as to its carcinogenicity to humans.

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See Chapter 2 for more information on the effects of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene on your health.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO NAPHTHALENE, 1-METHYLNAPHTHALENE, AND 2-METHYLNAPHTHALENE?

Several tests can find out if you have been exposed to naphthalene. These tests include measuring naphthalene and naphthalene breakdown products in urine, stool, blood, or maternal milk. If you have eaten something made from naphthalene, like mothballs, your stool can be checked for unabsorbed naphthalene. A small sample of your body fat can be removed and analyzed for naphthalene. Tests for naphthalene and naphthalene breakdown products require special equipment and are not routinely available in a doctor's office. Body fluids, urine, stool samples, or tissue samples can be sent to a special laboratory for the tests. These tests cannot determine exactly how much naphthalene you were exposed to or predict whether harmful effects will occur. The tests can show if you were exposed to a large or small amount of naphthalene. Urine tests, like stool tests, stop working 8-24 hours after naphthalene has passed through your body.

2-Methylnaphthalene and its breakdown products can be detected in the urine. Scientists know little about 1-methylnaphthalene or how to easily test for exposure to it.

See Chapters 2 and 6 for more information on tests for exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government has developed regulations and advisories to protect individuals from the possible health effects of naphthalene in the environment. The Occupational Safety and Health Administration (OSHA) set a limit of 10 parts per million (ppm) for the level of naphthalene in workplace air over an 8-hour workday. The National Institute for

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Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health.

The EPA recommends that children not drink water with over 0.5 ppm naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime, EPA suggests it contain no more than 0.02 ppm naphthalene.

Industrial releases of naphthalene into the environment of more than 100 pounds must be reported to EPA.

There are no regulations or advisories for 1-methylnaphthalene or 2-methylnaphthalene now.

See Chapter 7 for more information on government regulations for naphthalene

1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE
Atlanta, Georgia 30333
(404) 639-6000

This agency can also provide you with information on the location of occupational and environmental health clinics. These clinics specialize in the recognition, evaluation, and treatment of illness resulting from exposure to hazardous substances.